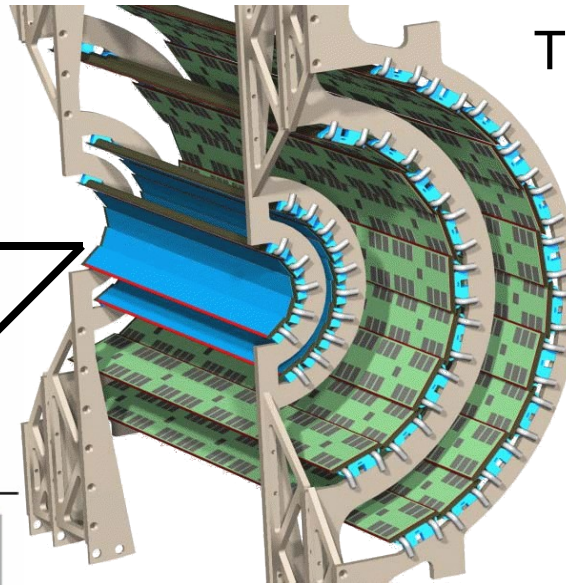
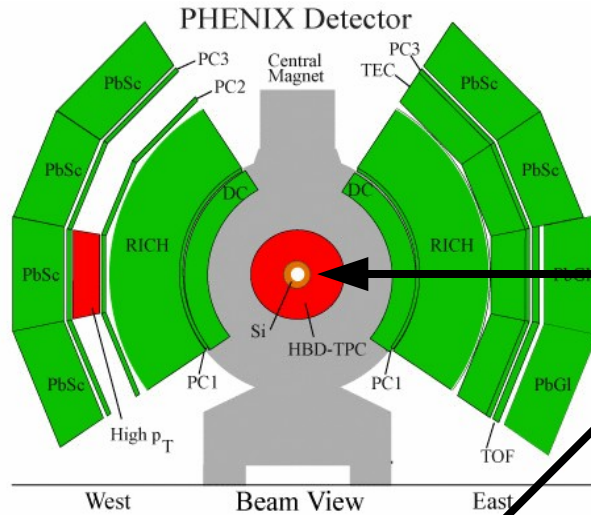


Silicon Vertex Detector Upgrade Performance

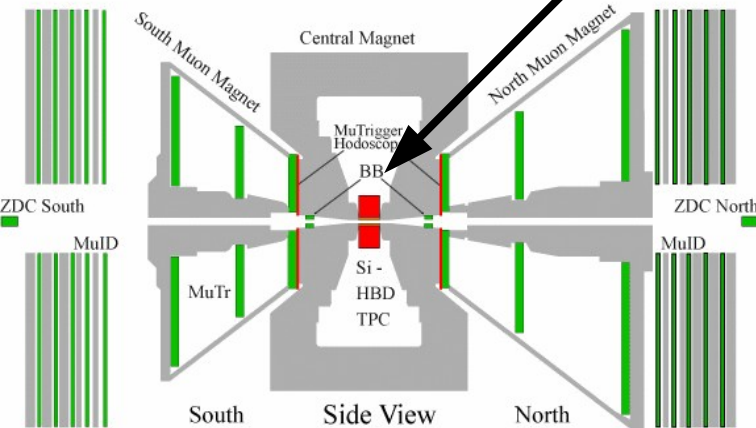
Sasha Lebedev, ISU

Silicon Vertex Detector



Two inner layers: $50 \times 425 \mu\text{m}$ pixels.
Two outer layers: “stripixels”
(effective size $80 \times 1000 \mu\text{m}$).

Large acceptance:
Covers ~ 2 units in η
and almost 2π in azimuth



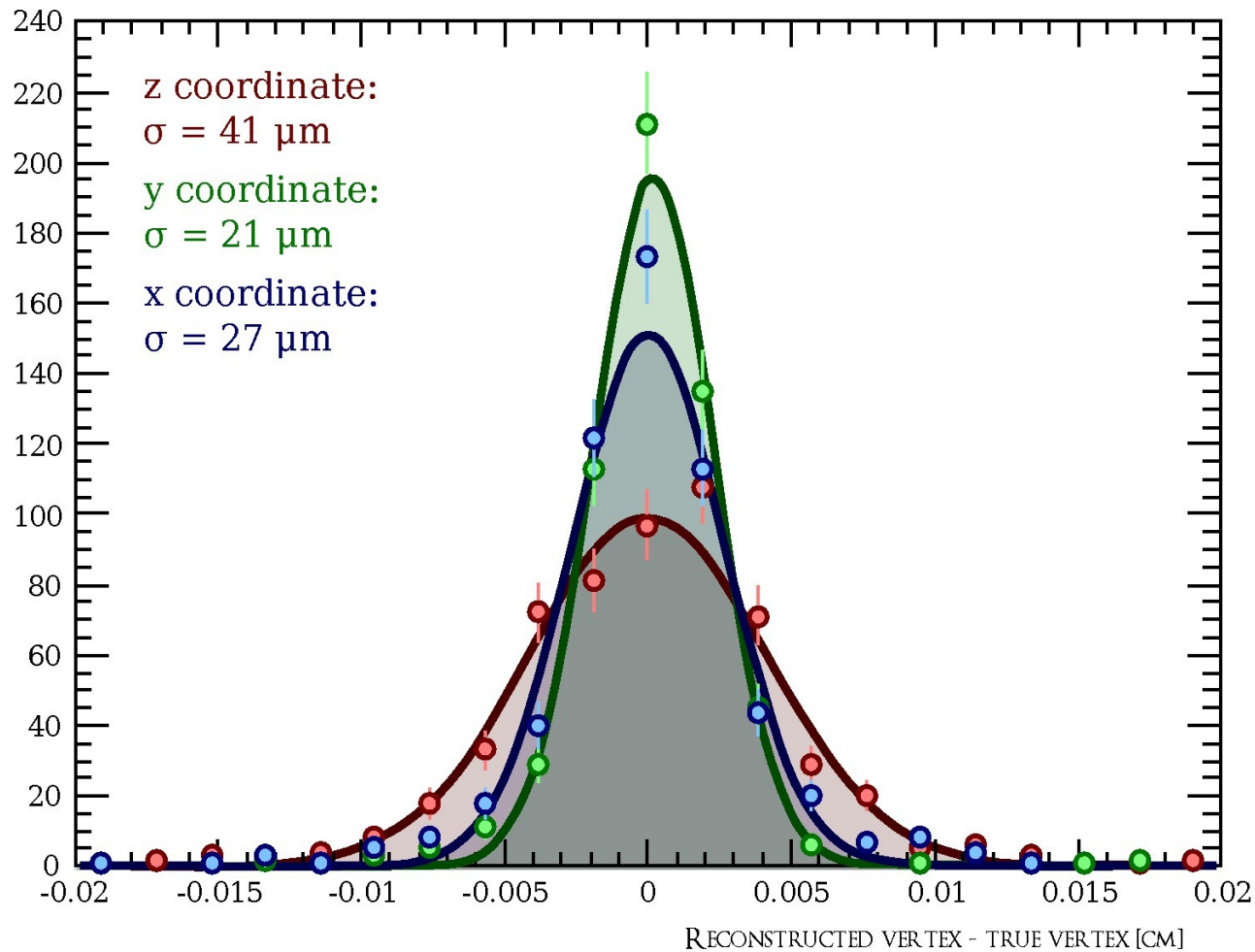
- Provides accurate event vertex measurement.
- Allows direct measurement of open charm and bottom, via displaced vertex.
 - semileptonic B/D decays, D^0 to $K\pi$,
B to J/ψ

- Large acceptance allows better jet axis measurement
 - heavy flavor jet tagging
 - gamma-jet correlations
- Large acceptance could help flow measurements.

To be installed in 2010.

Event Vertex Reconstruction

Minimum bias Hijing Au+Au events.
Full simulation and reconstruction.

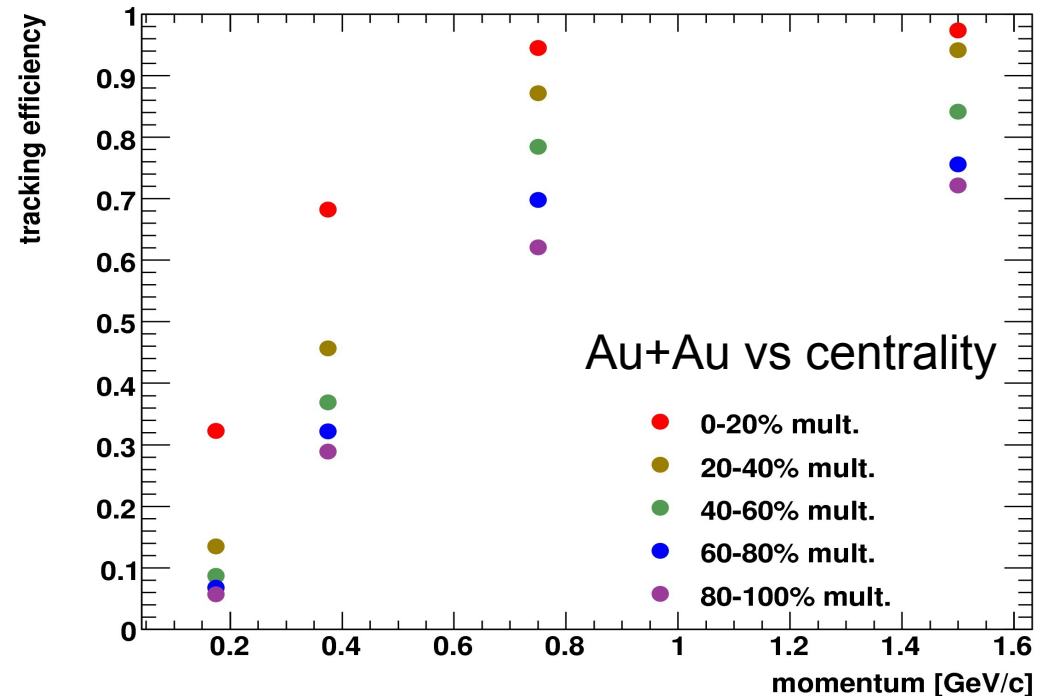
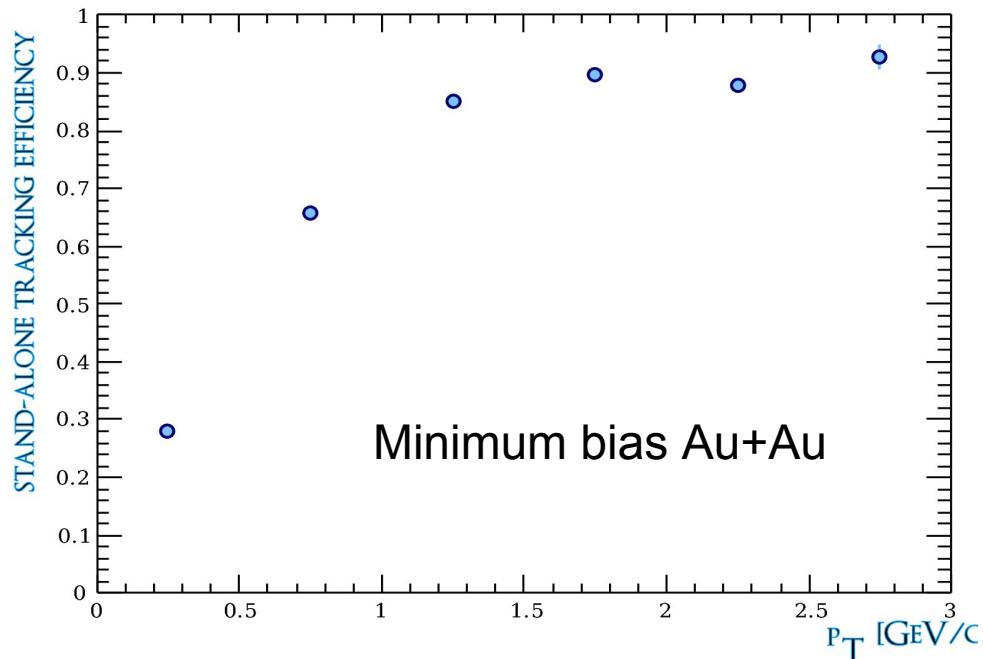


Resolution in X is worse because of the gaps in acceptance at top and bottom.

Standalone Tracking Efficiency

- Hijing Au+Au events.
- Full simulation and reconstruction.
- Efficiency for ghost track fraction 10% in all cases

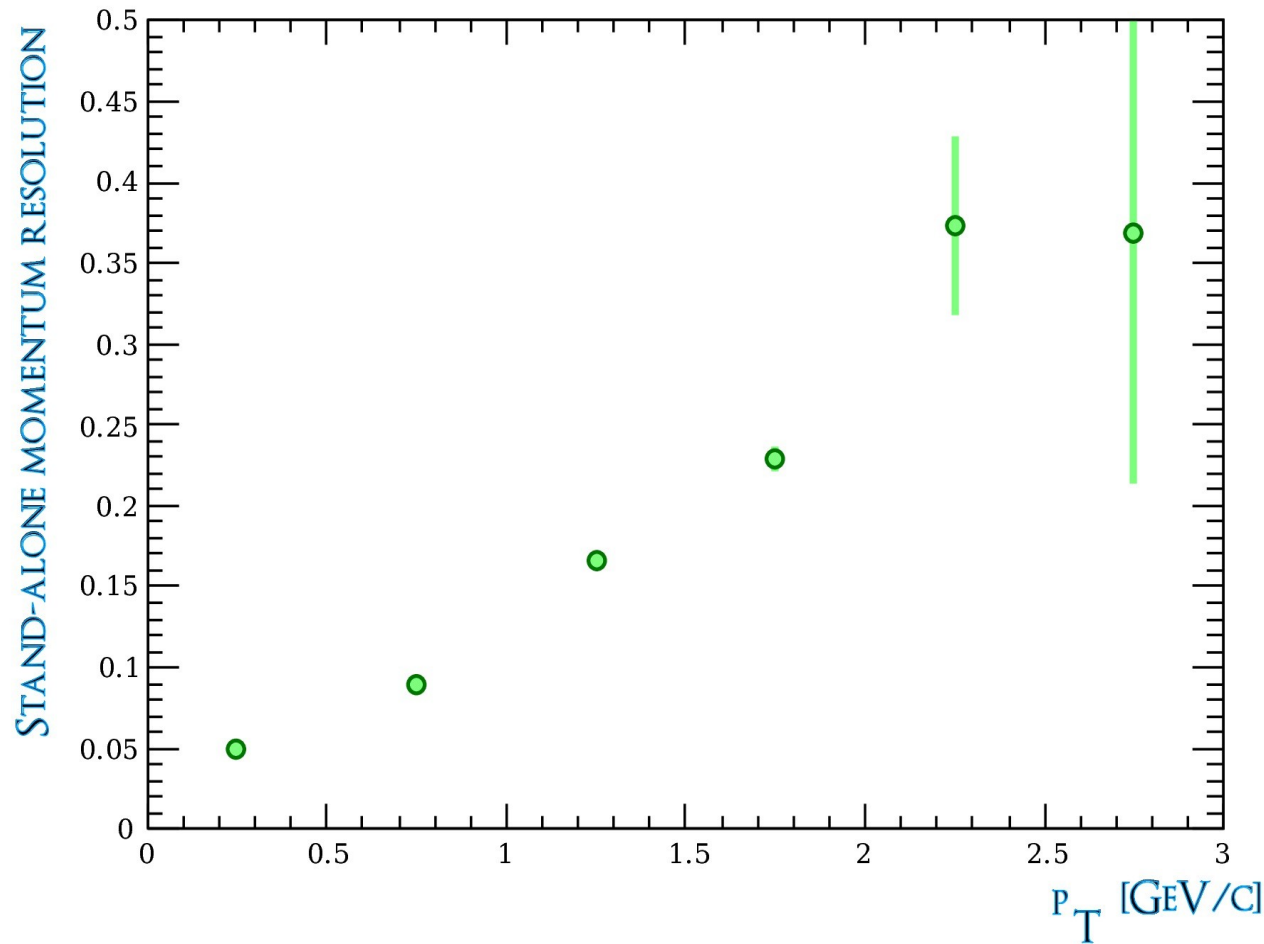
Efficiency is determined by requiring clusters associated with a track to be produced by correct GEANT hits (using PISA ancestry).



Standalone tracking is still being improved.
We expect even better results in the future.

Standalone Momentum Resolution

Minimum bias Hijing Au+Au events.
Full simulation and reconstruction.

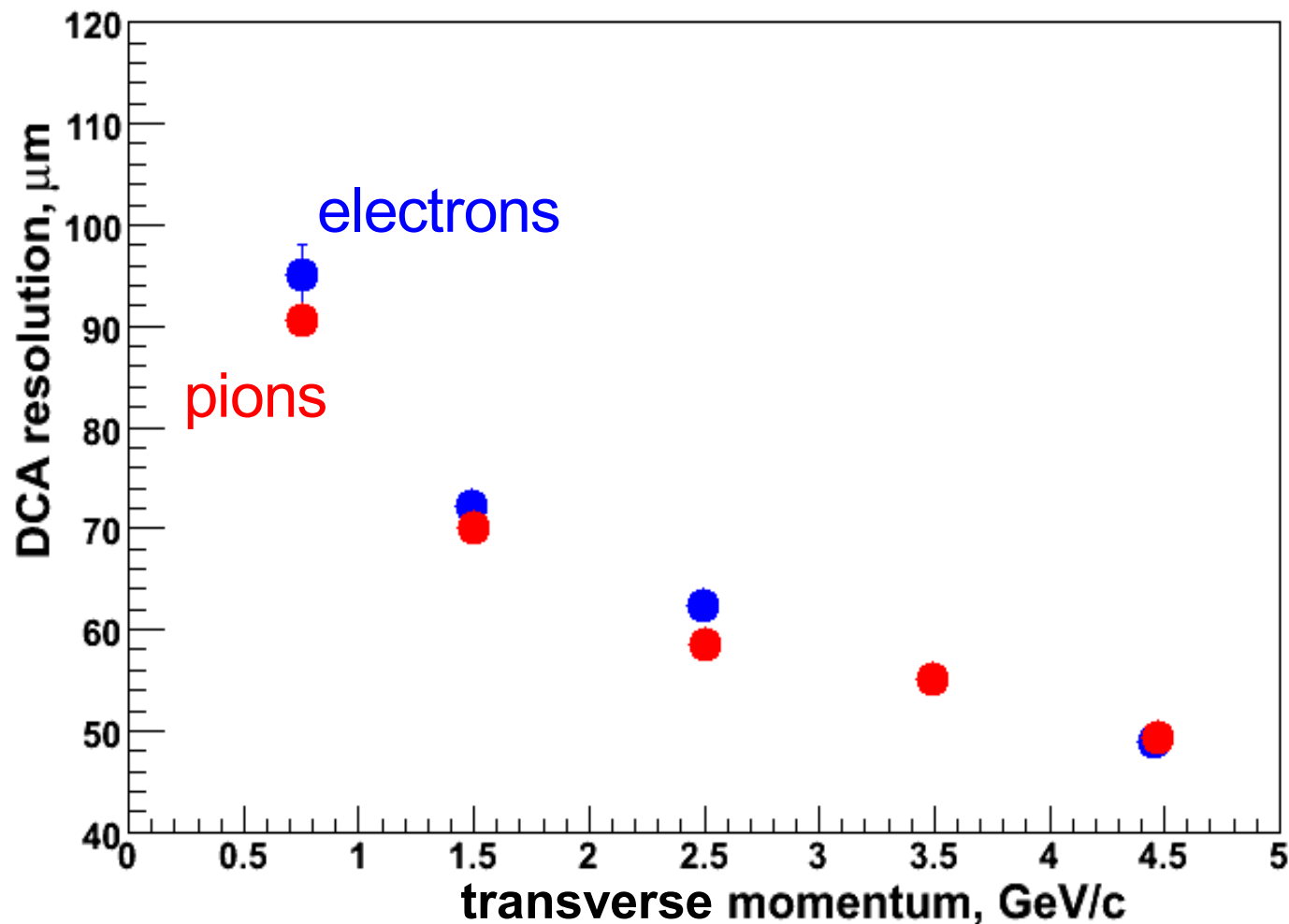


DCA Resolution

Single particles embedded in PYTHIA p+p events.

Full simulation and reconstruction.

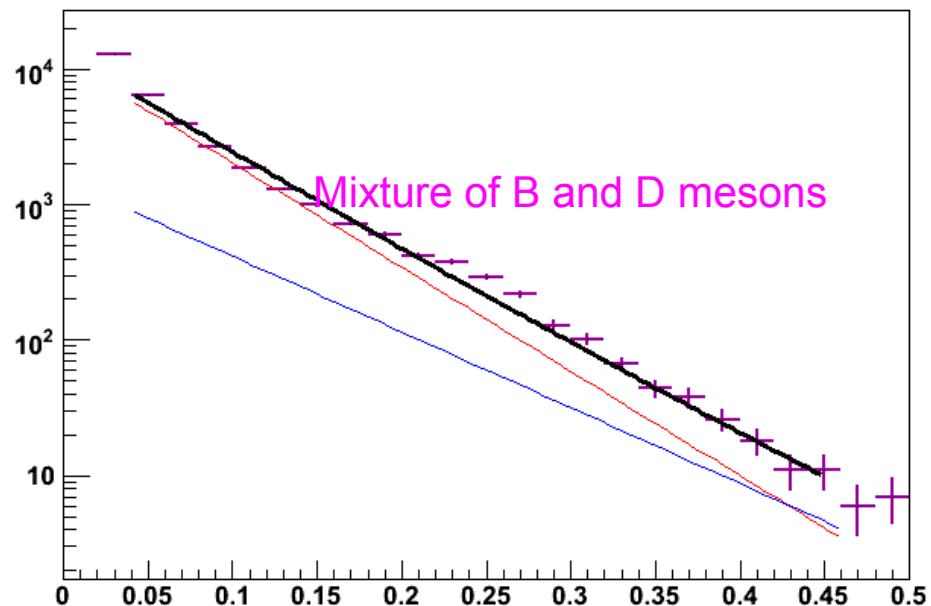
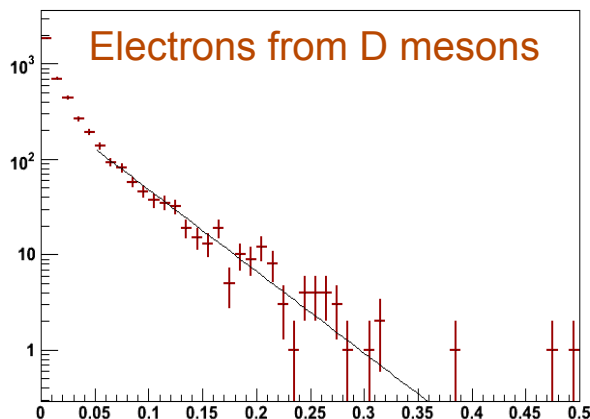
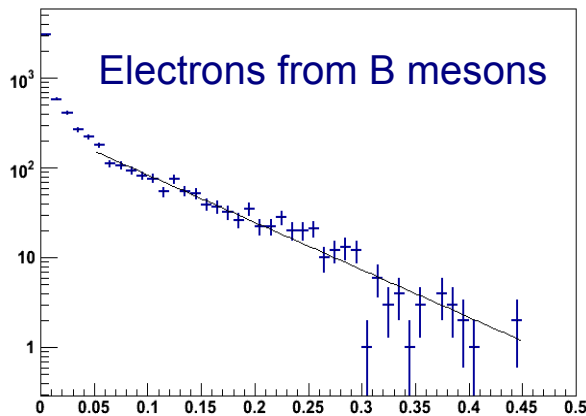
Distance of Closest Approach is calculated using KalFit package.



Bottom/Charm Separation

- Single B and D mesons decaying to electrons (produced by PYTHIA) merged with PYTHIA p+p events.
- Full simulation and reconstruction. Two different data sets: minimum bias (equivalent to $\sim 400B$ events), and $\text{ckin}(3)=3\text{GeV}$ (different p_T distributions). Each data set has samples with different charm/bottom ratio.

The separation procedure is based on difference between DCA distribution for B and D mesons. If we know DCA slopes for B and D mesons, we can fit DCA distribution for B+D mixture and thus obtain B and D content in the mixture.



But we don't know B/D slopes in advance!

Bottom/Charm Separation (2)

The problem is that you need to know what is DCA slope for B and D mesons in advance (and they depend on meson p_T distributions).

To overcome this problem, we can use iterations. Use a guess at the slopes for the first iteration, separate charm and bottom, use measured p_T distributions for the second iteration, etc. This did not work well so far.

New approach: predict DCA slopes for B and D from a measurement.

DCA slopes can be predicted from one measurement of DCA slope (S_O) for the charm/bottom mixture at low p_T :

$$S_{\text{CHARM}} = 1.1 S_O \text{ pow}(p_T, 0.1)$$

$$S_{\text{BOTTOM}} = 1.1 S_O \text{ pow}(p_T, 0.1) / 1.5$$

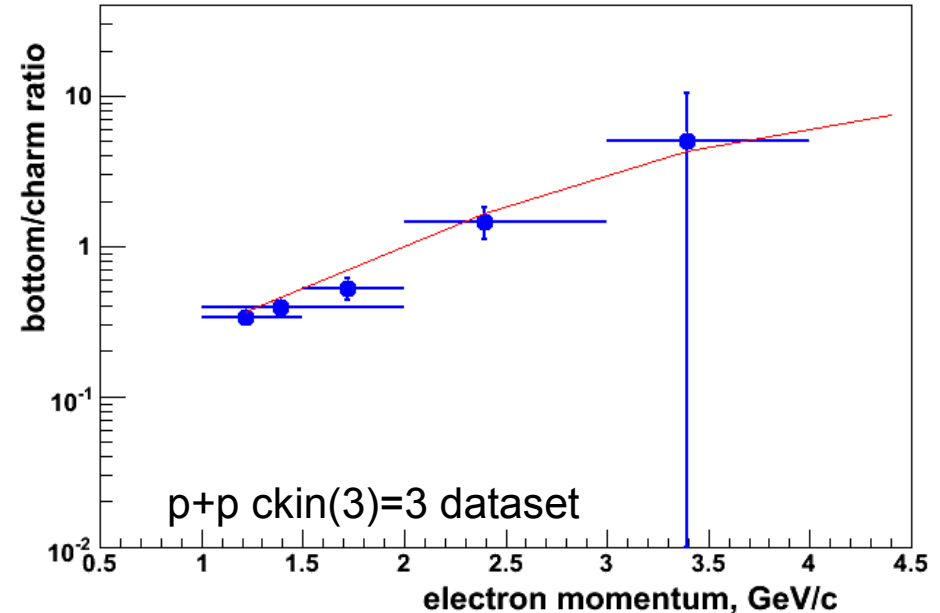
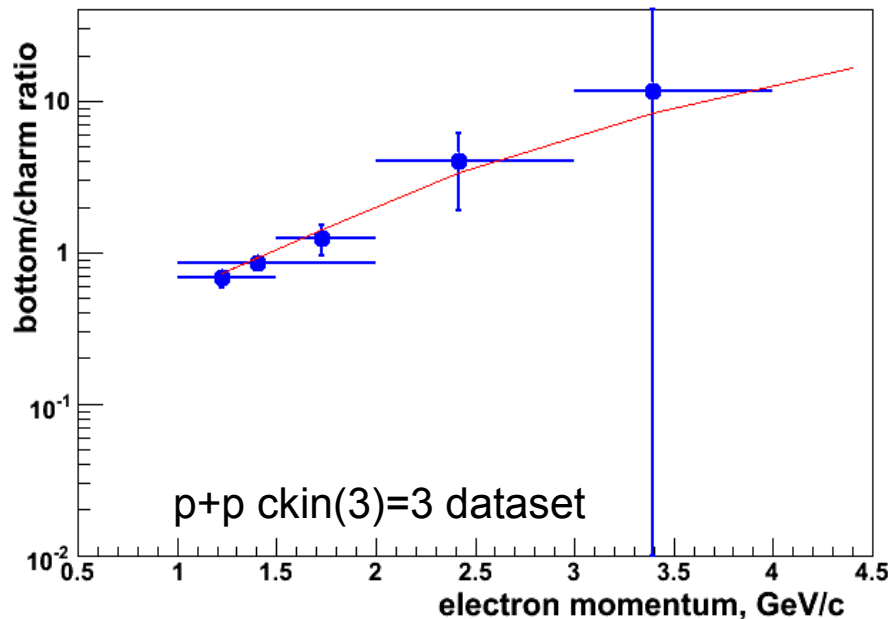
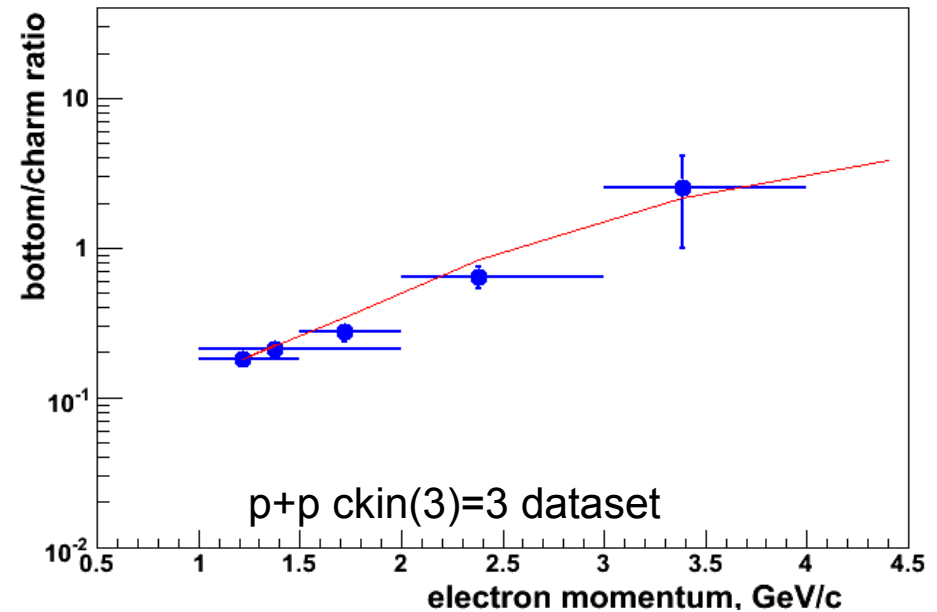
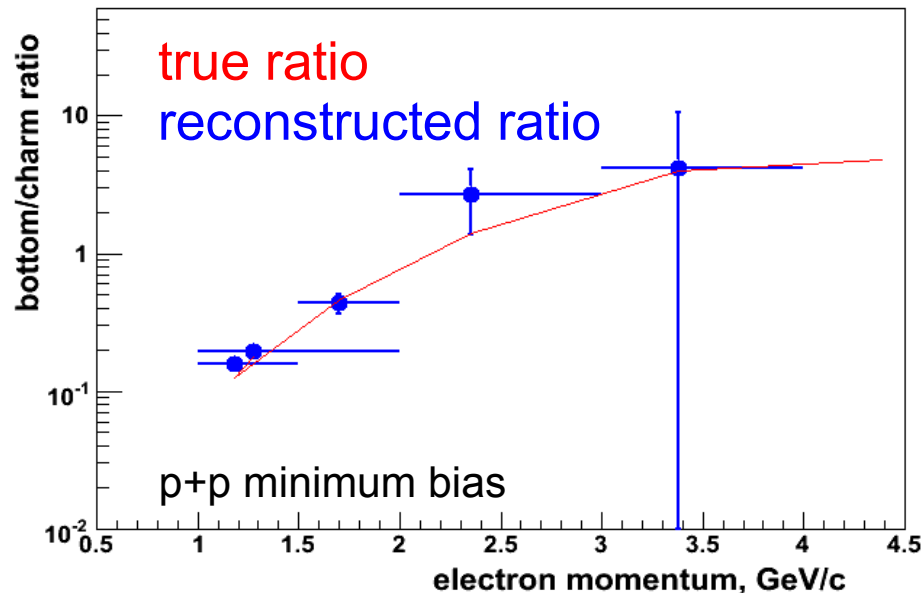
Examples of such separation are shown in the next slide for p+p.

The only assumption in these plots is that D/B mesons are embedded in every p+p event, so the background is lower than in reality.

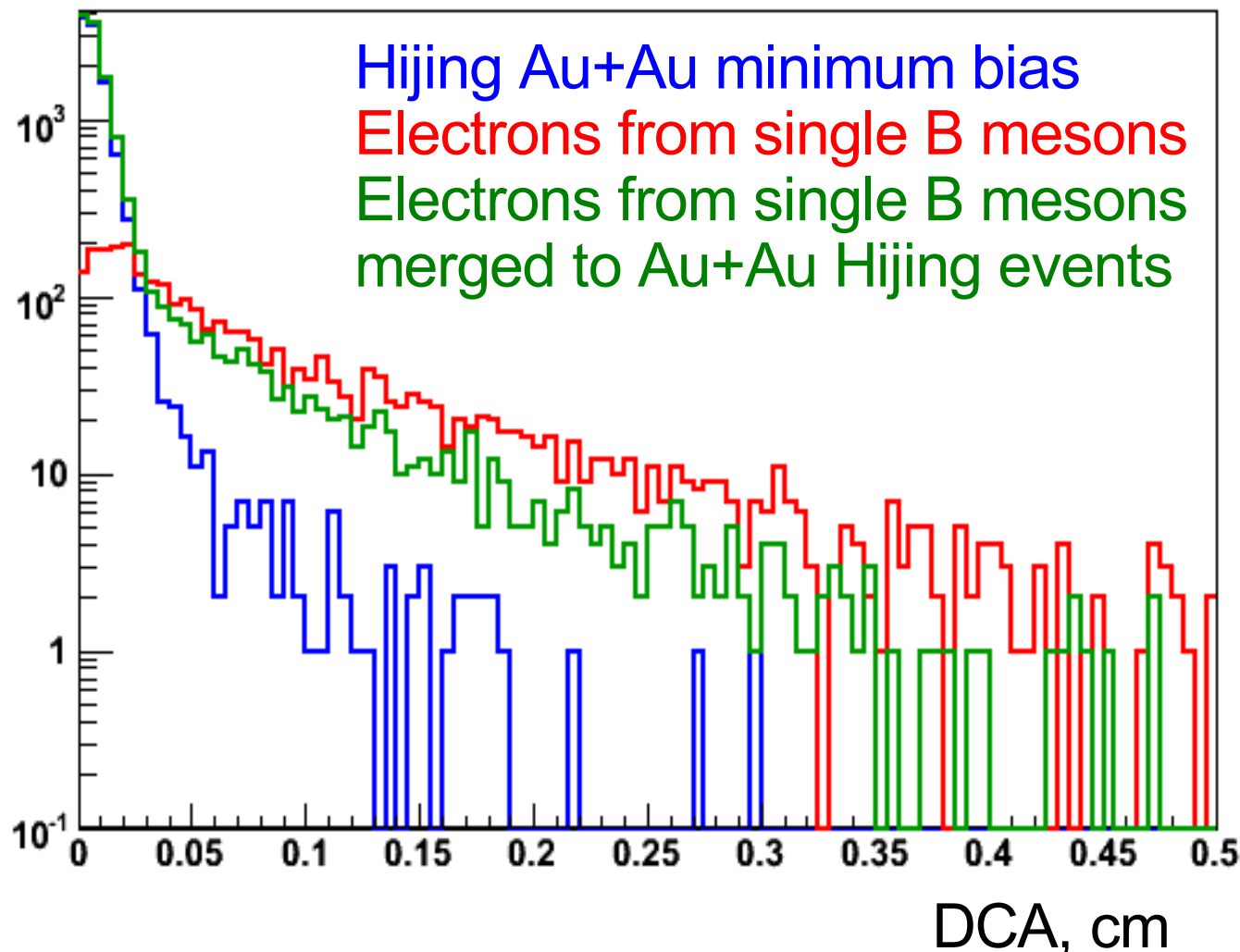
But we can remove Dalitz electrons by DCA cut and conversions by other means.

Bottom/Charm Separation Examples

The difference between 3 kin(3)=3 plots is different B meson content



DCA measurement in Au+Au



- 1) Simulate and reconstruct minimum bias Au+Au Hijing events, plot DCA distribution (blue).
- 2) Simulate and reconstruct single B-mesons decaying to electrons, plot DCA distribution for those electrons (red).
- 3) Merge single B mesons with Au+Au events, do full simulation and reconstruction, plot DCA distribution (green).

DCA calculated by KalFit package
Efficiency $\sim 60\%$. We are still working on improving both standalone and global (KalFit) tracking.

Work in progress

- Jet reconstruction.
- Flow measurements.
- Low P_T Particle PID based on multiple scattering,
- Blind analysis challenge.

Backup Slides

